Seeds of Science:

Ideonella Sakaiensis - the Plastic Eating Germ

The Secret World of Germs
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Introduction

- 400 million tonnes[1] of plastic waste was produced globally last year mostly disposed to landfill or the environment.
- This is a big problem for humans, animals and the environment as it contributes to sickness, air pollution and global warming.
- Scientists are finding it hard to break down plastics and we need a solution.
- In 2016, a bacteria named Ideonella Sakaiensis was accidentally found in Sakai, Japan[5] .
- This is the first ever bacterium that can fully break down. Polyethylene Terephthalate (PET) which is found in plastic bottles.
- Scientists have bought the bacteria into labs and transformed the enzymes from it to their own engineered microorganisms to speed up the process of breaking down PET.
- One plastic bottle takes 450 years to break down in landfill. It takes a few days using Ideonella Sakaiensis in a lab.
- The plastic problem is getting worse by the year. The discovery of Ideonella Sakaiensis sows the seeds of science for more research into breaking down plastics in the world today.

Explanation of Scientific and Technical Principles

Ideonella Sakaiensis was found outside a plastic bottle recycling facility in some sludge. Scientists noticed plastic breaking down. ***(Diagram 2)***

Here are the steps involved*:*

1. **Bacteria stick on to plastic surface (PET)**
2. **First stage (PET to MHET)**
   - **Bacteria** releases an enzyme PETase to break down PET into smaller pieces.
   - Produces a molecule called **MHET.**
3. **Second stage (MHET to Momomers)**
   - Bacteria uses another enzyme called METase.
   - This breaks into two blocks - erephthalic acid and ethylene glycol.
4. **Third stage (bacteria digests the blocks)**
   - It uses these as its main food source.
5. **Final Stage**
   - Breathes out Carbon dioxide (CO2) and poos (H2O).
   - No toxic waste is produced. This is amazing!

There are 3 different types of plastics usually used in a plastic bottles ***(Diagram 3)***. Ideonella Sakaiensis only breaks down PET:

1. Cap: **Polypropylene (PP)** or High-Density Polyethylene (HDPE).
2. Main bottle body is constructed from **Polyethylene Terephthalate (PET)**.
3. Label is typically made of **Biaxially Orientated Polypropylene (BOPP)**.

Diagram 1: 2025 produced enough plastic bottles to fill the MCG 16,000 times.



X 16,000

Diagram 2: Hand drawn image of plastic breakdown by Ideonella Sakaiensis bacteria.

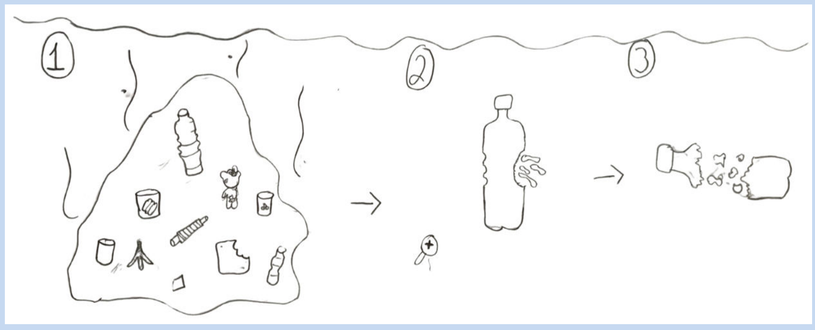


Diagram 3: Different types of plastic often used in a single plastic bottle and the section of the bottle the Ideonella Sakaiensis bacteria eats/ breaks down.



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Significance and Impact

- Ideonella Sakaiensis (bacteria) was found by a group of scientists in Japan and was a huge breakthrough for science and breaking down plastic.
- A group of scientists started testing but they found the germ was slow and are trying to speed up the germs process.
- It's significant because it will help reduce the impact of PET plastic on and in our environment.
- Plastic is non-biodegradable which means it can't breakdown and is in our bodies and environment for a long time.
- Since the 1950s, 8.3 billion tonnes of plastic have been made, with 79% ending up in landfills or the environment.
- All the worlds plastic bottles from 2025 would fill the MCG 16,000 times! ***(Diagram 1).***
- Although PET is the most recycled plastic in Australia, more than half of it still ends up in landfills.
- Ideonella Sakaiensis is the world's first PET-eating germ. It could be a good way a way to reduce plastic and it could contribute to reducing global warming and air pollution.

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